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Abstract

We draw on theories and empirical findings from urban economics to explore and explain patterns of city growth in the Middle Ages (c. 800-1500 CE). We discuss how agricultural development and physical geography determined the location and size of cities during the medieval period. We also consider the relative importance of economies of scale, agglomeration, and human capital spillovers in medieval cities and discuss how their growth was limited by disamenities and constraints on mobility. We discuss how medieval cities responded to shocks such as the Black Death and describe how institutions became increasingly important in determining their trajectories. Avenues for future research are also laid out.

JEL Codes: R11; R12; R19; N9; N93; N95

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How well do economic theories of urban development explain historical city growth? We draw on theories and empirical findings from urban economics and economic history to explore and explain patterns of city growth in the Middle Ages. We focus on the period between the establishment of the Carolingian Empire under Charlemagne (c. 800 CE) to the beginning of the Age of Discovery (c. 1500 CE). Though we do discuss city growth in the Middle East, we focus on Europe. It was during this period that the basic structure of the European urban system evolved. It also witnessed urbanization and the expansion of trade—the Commercial Revolution, one of the largest shocks in history—the Black Death, and the development of institutions which are now integral to modern life (e.g. universities and parliaments).

1. Urbanization Patterns during the Medieval Period, 800-1500

1.1. Urbanization Patterns in Medieval Europe, 800-1500

The main resource for medieval city sizes is the data compiled by Paul Bairoch (Bairoch et al., 1988). This reports population estimates for 2,204 cities – defined as localities of at least 1,000 inhabitants – for 26 European countries (defined as of 1988, including Russia) between 800 and 1850. Bairoch's dataset begins in 800, a low-point in the urban history of Europe. The largest cities outside of Muslim Spain were Naples and Rome with approximately 50,000 inhabitants. In total, Bairoch records only 36 cities with populations greater than 2000 inhabitants. Europe in 800 was less urbanized than it had been during the Roman Empire.

We illustrate this using estimates Bairoch (1988) provides for the year 200. Figure 1a shows the urban shares based on cities above 2,000 and 5,000 inhabitants.[1] Figure 1b shows the total urban populations based on the same thresholds. As can be seen, the urbanization rate based on 2,000+ cities was around 11% in 200, approximately at the peak of the Roman Empire.[2] Rates above 10% are, in general, characteristic of more developed pre-industrial societies.

Total urban population and the urban share decreased between 200 and 800 due to economic decline, the collapse of the Western Roman Empire, the Justinian Plague (541–542), and climate change (Harper, 2017). The population of Rome, for example, fell from 1 million in 100 to 50,000 in 800. From a low point in 800, urban populations increased. The slow rate of aggregate increase hides the fact that urban growth was rapid in parts of Europe, notably Italy (which reached an urbanization rate of 15-16%) and in the Low Countries and Rhineland. In contrast, England

[1] It reports an urban share for the whole of Europe, excluding Russia. For 78 countries that used a threshold-based urban definition circa 2015, Jedwab and Vollrath (2015) find that the "median threshold is 2,500 inhabitants but the mean threshold is 4,362", not far from the 2,000 and 5,000 thresholds.

[2] Urbanization rates for the Roman empire, as opposed to Europe, were higher. Bairoch's estimates are also conservative as he underestimated Roman urbanization levels relative to more recent scholarship (see Wilson, 2011).

lacked a dense urban network of the sort that characterized Italy, reflecting its peripheral status on the north-western edge of Europe's trading networks (Campbell, 2008).

To gain insight into urban population growth between 800 and 1500, we use data from Bairoch et al. (1988).[3] First, the number of cities increased, whether we use 2,000 or 5,000 as a threshold (see Figure 2a). Second, urban growth was driven by existing cities becoming larger, i.e. the intensive margin of urban growth (Figure 2b shows for each year t the total urban population respectively coming from cities that existed in t-1 or new cities). Indeed, Figure 2c shows that mean city size increased when considering all Bairoch localities or the 10 largest cities in each year.[4] These data reveal that it was during this period that most of the cities of modern Europe emerged. Of the cities in 1800 with populations greater than 20,000, 93% existed by 1300.

1.2. Urbanization Patterns in the Rest of the World, 800-1500

In 800 the Middle-East and North Africa were among the most urbanized regions in the world. Many cities were founded with the expansion of Islam. Indeed, because these conquests also brought agricultural innovations and opened whole regions to new maritime and overland trade routes, Islamization was initially associated with urban growth (Kuran, 2010; Rubin, 2017).

In the long run, however, Muslim cities did not experience the same growth as European cities. After 1000, urbanization rates did not increase over time.[5] Using the data from Bosker et al. (2013) who report population estimates for cities above 10,000 inhabitants in 800-1500, we indeed find that the Middle East had many relatively large cities before the year 1000, almost the same number as Europe (see Figure 3a).[6] The total urban population of the Middle East exceeded the total urban population of Europe until 1000 because Muslim cities were larger on average (see Figure 3b). After 1100, one can see that the Middle East's total urban population slightly declined whereas Europe's total urban population kept increasing.

Changing patterns of world trade help to explain the relative stagnation of Middle Eastern cities. Blaydes and Paik (2020a) explore how changing trade routes shaped the size of cities in the Middle East and Central Asia. They find that distance to a Muslim trade route is associated with urbanization in 1200. But that after 1500 the importance of these overland Muslim trade

[3] Observations are provided for every century up to 1700 and then for each fifty year interval up to 1850. The criterion for inclusion in the "Bairoch" database is a city at any point between 800 and 1850.

[4] One issue with the Bairoch database is that in the earlier years few small cities are reported, which complicates the calculations of average city size. To remedy that fact, we consider *all* Bairoch localities, i.e. all cities with a population above 1,000 at one point, and take their average population size in each year t (using 1,000 if the city is reported as such and 500 if the city's population is below 1,000 and no population estimate is reported).

[5] Several recent explanations for this relative stagnation are that there was a decline in scientific activity (Chaney, 2016), institutional stagnation (Kuran, 2010; Rubin, 2017), or a decline in trade (Blaydes and Paik, 2020b).

[6] Both Europe (including Western Russia) and the Middle East for which Bosker et al. (2013) report population estimates have a total area of about 10,000,000 sq km, making their respective numbers of cities comparable.

routes declined and that by 1800, they are uncorrelated with urbanization.

To study other regions of the world we rely on Chandler (1974, 1987) which reports population estimates for 435 world cities for selected years during the period 800-1500.[7] To create a consistent population series for each year $t = \{800, 900, 1100, 1200, 1300, 1400, 1500\}$, we interpolate population between years. We then use for each year t the population in year t if available, and if not we use the mean population of each city in the period (t-50; t+50) in order to maximize the number of cities with a population estimate in the period.

As can be seen in Figure 4, the total population of cities in the Chandler data increased the most in Europe, then South Asia and East Asia. The total population of other regions remained stable or even slightly declined. Central Asian and pre-Columbian societies were relatively developed and urbanized. However, on average, their total urban populations did not increase during the period. Recent work has explored city growth in Central and East Asia (see, Blaydes and Paik (2020c)) but this remains an area in need of further research.

2. Medieval Cities Through the Lens of Urban Economic Theories

Next we relate several leading theories of urban development to the evolution of medieval cities. We consider both theories used by economic historians studying cities in a preindustrial setting as well as theories developed by urban economists, usually to explain contemporary cities.

2.1. The Food Surplus Hypothesis

Scholars have long associated the emergence of cities with the development of agriculture. By definition a city requires a certain density of population and many of these individuals will not be working directly in food production. This requires a food surplus (Gollin et al., 2002). Bairoch (1988, p.94) noted: "For while it is true that urbanization could not get under way without the concentration of population and the surplus of food resulting from agriculture, it is equally true that the emergence of agriculture set in motion forces that sooner or later led to the growth of cities". One should thus expect more urbanized regions where agricultural productivity was high. Trade also allowed regions to import food, thus creating more urbanization at a given level of productivity (Glaeser, 2014; Gollin et al., 2016). During the medieval period, transportation costs were high in general. But they were relatively lower in cities located along a natural transportation system such as a river or sea (Pounds, 1973; Braudel, 1992). Thus, one would expect more urbanization in naturally well-connected regions where grain could be imported. In addition, transporting food to cities was hindered when there was a lack of state control over

[7] The Chandler data set was geospatialized by Reba and Seto (2016).

hinterlands—resulting in excessive tolls assessed by local lords (Heckscher, 1955; Braudel, 1992).

There have been several tests of the food surplus hypothesis. Motamed et al. (2014) find that urbanization occurred sooner in places with higher agricultural potential and lower (natural) transport costs. Nunn and Qian (2011) use a positive shock to agricultural productivity—the introduction of the potato after 1492—to show that cities in regions with soil more suitable for potato cultivation grew faster. Other examples of positive productivity shocks include the invention of a new farm tool like the heavy plough, which allowed farmers to exploit the fertile clay soils of Northern Europe after 1000 (Andersen et al., 2016).

There is evidence that close to large urban centers that offered a ready market, more commercialized and capital intensive agricultural techniques were employed and high yields could be obtained (Campbell et al., 1993; Grantham, 1999). However, in general increases in agricultural productivity were modest and agricultural productivity remained low.

Mitigating this is the fact that beginning in the eleventh century the Commercial Revolution saw large increases in long-distance trade across Europe, thereby lowering the cost of feeding cities (Lopez and Lopez, 1976). Studies by economic historians have suggested origins for this flourishing of trade in the development of decentralized institutions, often linked to cities. For example Greif et al. (1994) argue that a "Community Responsibility System" developed between towns whereby they agreed on credible strategies to enforce long distance trade agreements in the absence of third party enforcement. Likewise, Greif and Tabellini (2017) suggest that the organization of corporate entities based on civic values that emerged in cities during this period played a major role in facilitating trade, in contrast to the clan-based organization of urban governance in China.[8] As a result, Greif and Tabellini (2017, p. 6) argue that cities in Europe, "…provided legal enforcement, schooling, commercial infrastructure, and other local public goods." In contrast to this emphasis on private-order institutions, Edwards and Ogilvie (2012) and Ogilvie and Carus (2014) have argued that the success of these urban institutions relied on political institutions to provide legal and enforcement services.

2.2. The Preponderance of Natural Advantages over Man-Made Advantages?

There is evidence that both geography–i.e., natural advantages, and history–i.e., man-made advantages affect the location of economic activity. Numerous studies (e.g., Beeson et al., 2001; Bosker et al., 2013; Maloney and Caicedo, 2015) find that geography has a strong impact on spatial development, implying that historical shocks have only temporary effects (e.g., Davis and Weinstein, 2002). Other studies find that localized shocks had permanent spatial effects

[8]Relatedly, Schulz (2018) argues that the decline in clan-based relations in Europe is to be found in the ban on cousin marriage by the Catholic church, also resulting in higher city growth for cities more affected by this legislation.

(e.g., Bosker et al., 2007; Bleakley and Lin, 2012; Jedwab and Moradi, 2016; Jedwab et al., 2017a), indicating the presence of path dependence and the existence of multiple spatial equilibria, with historical happenstance determining which of these equilibria was selected. Was geography or history more relevant for explaining the medieval spatial equilibrium?

Bosker and Buringh (2017) use data on the location of European cities in 800-1800 to argue that "geography is the dominant determinant of city location". Water and land-based transportation became increasingly important (relative to agricultural potential) over the period, indicating how trade came to increasingly matter for Europe's urbanization. They also find evidence for an urban shadow effect in that existing cities made it less likely for other cities to emerge nearby. Bosker et al. (2008) find that within Italy being a seaport or having access to navigable waterways increases city size. Bosker et al. (2013) find a similarly important role of geography in the Middle East, where many cities grew along the Mediterranean coast, rivers, or water stops for caravans (the camel was indeed the "ship of the desert"). They also find that the decline of the Middle East (relative to Europe) was due to the fact that "efficiency gains in the caravan trade were low [...] compared to those in water-based transportation [...] due to innovations in shipbuilding and improved sailing and navigation techniques." The advantages of geographical features suitable for camel-based trade weakened over time relative to natural ports and river locations.[9] More generally, scholars such as Pirenne (1925a), de Vries (1984), Hohenberg and Lees (1984) and Bairoch (1988) have argued that natural advantages were more important than man-made advantages in determining the location and size of medieval cities.[10]

Studies of the role of man-made advantages are scarcer. Wahl (2016a) finds a relationship between city-level measures of medieval trade and contemporary regional economic performance. However, such medieval trade measures could be related to other factors driving growth. Michaels and Rauch (2018) argue that historical events can trap towns in unfavourable locations, which would also be consistent with local increasing returns. Following the fall of the Western Roman Empire, urban centers collapsed in Britain, but not in France. As riverine trade became more important over time, medieval towns were more likely to emerge and flourish along natural navigable waterways in Britain than in France, making the overall urban system of Britain more spatially optimal. Du and Zhang (2019) find that Chinese cities that had walls during the late imperial period (960-1912) are more developed today, despite the walls

[9] Davis and Weinstein (2002) find strong evidence for historical persistence in the distribution of regional population density in 700-1600 Japan, thus suggesting a strong role for geography. Flückiger and Ludwig (2017) find that malaria suitability has historically prevented urbanization in various parts of China.

[10] Pirenne (p.138-139, 1925a) writes: "the towns of the Middle Ages were a phenomenon determined as much by physical surroundings as the course of rivers is determined by the conformation of the mountains and the direction of the valleys."

being long gone. Finally, as we will discuss in greater detail below, Jedwab et al. (2019b) study the shock of the Black Death (1347-1352)—which killed about 40% of Western Europe's population—and find that cities endowed with more natural advantages (e.g. agricultural potential, proximity to coasts and rivers) or man-made advantages (e.g. Roman roads) were likely to recover faster.

3. How Strong Were Agglomeration Effects in Medieval Cities?

Economies of scale and agglomeration economies are a source of the higher productivity and wages associated with cities.[11] There are different sources of economies of scale. For instance, economies of scale in *production* can cause a town to be organized around a few large production facilities (e.g., "factory-towns"). There are also *commercial* economies of scale: cities exist because they serve as physical places for the exchange of goods. Lastly, there are economies of scale in *public goods provision* (e.g., an aqueduct). Together, these different economies of scale can explain why cities often have only a few large firms or specialize in a few sectors.

However, to explain why some cities have many large firms and multiple sectors, agglomeration economies are necessary. These can be classified into three mechanisms: (i) *Sharing*: Cities are locations where many suppliers, and thus a variety of important inputs, can be found. By concentrating many firms and workers in the same location, the productivity gains from specializing in few products or tasks are also shared; (ii) *Matching:* Cities promote a better match between firms and suppliers and between firms and workers; (iii) *Learning:* Cities facilitate the creation of knowledge. There could also be *human capital spillovers* if a higher density of skilled individuals promotes the exchange of productive ideas.

In the absence of comprehensive data on real wages, however, empirical analysis of agglomeration effects is all but impossible. While consistent wage series exist for a few cities, they usually are complete for the post-medieval period only and for the largest city of each region or country, thus preventing researchers from calculating urban wage premia.[12]

Other measures important for the study of agglomeration effects are also almost always missing, whether employment, productivity, or firm creation and firm size. The absence of individual-level data also makes it impossible to control for spatial sorting. Finally, the geographic area over which population is recorded is often missing from data, making population density difficult to compute. One exception is Cesaretti et al. (2016) who estimates population density (using walled areas as a proxy for total area) for 173 European cities from the

[11] See Duranton and Puga (2004) and Rosenthal and Strange (2004) for surveys of the mechanisms described here.

[12] See, for example, the *Consumer price indices, nominal / real wages and welfare ratios of building craftsmen and labourers, 1260-1913* data base of Robert Allen. More wage estimates can be found here: (i) https://gpih.ucdavis.edu/Datafilelist.htm; and (ii) http://www.iisg.nl/hpw/data.php.

early 14th century and finds that density increases with city population size.

Rather than explicitly testing for agglomeration economies, instead, historical studies often attempt to classify medieval cities based on their specialization. For example, Bairoch (p.164-168, 1988) distributed the 1,450 cities of 14th century Europe and classified them according to their function: 60% of them were small towns with 2000-6000 inhabitants and "highly local functions", one or more churches, a local market, and the residence of artisans whose products served the needs of neighboring rural communities. Then there were about 300-330 "regional centers" [with between 4,000 and 12,000 inhabitants] that also served other, more specialized, functions. These cities typically had walls, and were thus important for defense purposes, served commercial functions, and were episcopal sees. Finally, there were about 210 "large cities" in excess of 8,000-12,000 inhabitants. Among these, one could find commercial cities specialized in international trade (as the Italian city-states or the Northern European cities belonging to the Hanseatic league), industrial cities specialized in the export of manufactured goods (textiles, as in the Low Countries), and administrative cities (national and regional capitals).

Without more data, one cannot determine the particular mechanisms driving city growth during the medieval period. But at the risk of generalizing, it seems that large medieval cities tended to have specific functions and were not that large overall.[13] For example, the mean size of the ten largest cities increased from about 50,000 in 800 to about 100,000 in 1500. To borrow the typology of Duranton and Puga (2001), medieval cities tended to be specialized cities where existing goods or services could be produced at a lower cost rather than diversified "nursery" cities where innovation was fostered by the coexistence of many different firms and sectors. In particular, among the largest cities, some were specialized in the production of one manufactured good, suggesting economies of scale in production. There were then commercial cities which most often did not produce any manufactured good. For these, commercial economies of scale must have been important. Finally, the growth of large cities was driven by acquiring political control of new territories, thereby ensuring access to food surpluses. Many large cities were large not because of economic mechanisms but because of political factors.[14]

4. How Important Was Human Capital for Medieval Cities?

Today larger cities are more likely to have high quality educational and professional training facilities due to economies of scale. This makes large cities human capital production centers.

[13] One way of thinking about whether larger medieval cities were "too small" is to look at the overall rank-size distribution to see if it matches the well known log-log, or, Zipf distribution. Dittmar (2015) finds that it was not until the seventeenth century that European cities followed a Zipf distribution—the big cities were too small until then.

[14] A classic, but still insightful, treatment of the importance of food security and trade for cities is Usher (1913).

Furthermore, cities, by easing face-to-face interactions between individuals, speed the flow of ideas, whether this is directly rewarded by the market or through *spillovers* (see Moretti (2004)). Due to the importance of human capital, cities with more skilled workers grow faster.

Was this true of medieval cities? Compared to the modern period, human capital was less important. Agriculture was the dominant sector and most farm workers needed little human capital. Nonetheless, and especially following the Commercial Revolution, other sectors of the economy grew in importance. Using data on sectoral shares of the medieval economy from England, Broadberry et al. (2015) estimate that in 1381, agriculture was 45.5% of GDP whereas industry was 28.8% and services 25.7%. To what extent did these sectors require human capital?

We can distinguish between the human capital requirements of various occupations, specifically between the human capital required by craftsmen and that required by merchants and bankers. Medieval cities were populated by craftsmen such as tanners, blacksmiths, wheelwrights, carpenters, butchers, or tallow workers. These skills were often acquired through apprenticeships that were usually, though not exclusively, organized through craft guilds (Epstein, 2008; Ogilvie, 2019). Whether or not guilds encouraged human capital accumulation on net is disputed.[15] On the one hand, guild-enforced apprenticeships helped overcome imperfections in the market for human capital and lowered the costs of transmitting tacit knowledge (De la Croix et al., 2018). On the other hand, guilds exerted both monopsonistic and monopolistic control over input and output markets and guild members used these apprenticeship institutions to extract rents. Moreover, by regulating labor supply in each sector, guilds also reduced human capital generation in the broader population (Ogilvie, 2019).

Merchants required greater human capital to succeed than most other medieval professions. They were literate and numerate and increasingly had to be able to keep complex accounts. Double-entry book-keeping—which diffused within Italy during the late Middle Ages—was a difficult skill to learn (de Roover, 1974). Merchants also had to learn commercial arithmetic. In the thirteenth century, Leonardo of Pisa pioneered the mathematics of discounting and working out the present value of an asset and as a result 'Italian businessmen learned techniques of valuation and discounting'(Goetzmann, 2005, 139). Much of this knowledge was transmitted directly from master to apprentice and this required a substantial investment. In some cities this education might have had a public component. The city of Lucca hired in 1345 an arithmetic teacher out of the public funds as the citizens were 'much engaged in business' (Spufford, 2002, 30). But this was rare and in general the provision of human capital was left to non-state actors. Other residents of medieval cities would have been less likely to have significant human capital

[15] For a summary, see Koyama (2020).

and there would have been a large population of unskilled workers.

Outside of labor markets, were skills generated by schools and universities? During the medieval period, there were indeed urban schools, often tied to monastic communities. Andersen et al. (2017) find that English communities closer to Cistercian monasteries grew faster. They attribute this to changes in attitudes towards work effort, willingness to adopt new technologies, and investment behavior transmitted horizontally from monks to the local populations. The first European university was founded in Bologna in 1088, and there were already at least 35 cities with a university by the end of the 14th century and at least 70 such cities by the end of the 15th century. However, such universities were, for most of the medieval period, largely training grounds for the Church and the law and did not provide their graduates with commercial or engineering skills (Miethke et al., eds, 2000). Yet, Cantoni and Yuchtman (2014) find that universities in Germany had positive economic effects for cities because they provided training in Roman and canon law, which emphasized contracts and property, two major foundations of commerce. They identify these effects by exploiting the Papal Schism of 1386, when there were two Popes, one from Rome and one from France, who competed to become the leader of the Catholic Church. This schism prevented Germans from studying in the France and prompted the formation of universities in Germany.

Technologies that reduced the costs of accessing knowledge also appeared in the late medieval period. Book production increased throughout this period, but it greatly accelerated following the invention of the printing press in Mainz circa 1440 by Johannes Gutenberg (see Buringh and Van Zanden, 2009). Dittmar (2011) finds that European cities where printing presses were established in the 1400s grew faster than otherwise similar cities, suggesting that access to knowledge and human capital became important drivers of urban economies.

Together these developments are consistent with the finding that the skill premium was declining in Europe in the late Middle Ages, indicating a more widespread diffusion of skills and human capital (van Zanden, 2009a; Van Zanden, 2009b).

Finally, one important ethnic and religious minority group for which human capital formation was particularly important are Jews. During the first half of the fourteenth century a lower-bound estimate is that between 20% and 40% of the cities in the Bairoch data set had a Jewish community (Johnson and Koyama, 2017a; Jedwab et al., 2019a). Due to historical developments in the first millennia CE, Jews in medieval Europe had significantly higher levels of human capital than Christians. In particular, literacy was almost universal among adult male Jews (Botticini and Eckstein, 2012). As a result, Jews were disproportionately represented in skill-intensive sectors where they could use their knowledge but also exploit the links between

their communities. Many of them were merchants, bankers, and doctors whose value was well recognized by contemporaries (Chazan, 2010). Johnson and Koyama (2017a) show using an instrumental variables strategy that cities with a Jewish community grew significantly faster than cities without Jews—with this growth advantage accelerating into the early-modern period. In many locations the relationship between Jews and money-lending illustrated how political institutions were constructed to exploit religious differences in medieval Europe. City leaders would erect bans on lending money at interest (usury restrictions) which applied only to Christians. They would then grant Jews a monopoly privilege to lend money and tax the resulting profits away (Johnson and Koyama, 2019; Koyama, 2010). The resulting political economy equilibrium acted simultaneously to allow governments to avoid investing in fiscal capacity, increased antisemitic beliefs, and made persecution of Jewish communities more likely.

5. What Was the Relative Role of Wages vs. Housing vs. Amenities?

City populations can be understood as the outcome of a spatial equilibrium in which utility is equalized across locations in the presence of free migration (Rosen, 1979; Roback, 1982).[16] Higher incomes observed in some cities should be offset by higher prices or low amenities. However, whether this spatial equilibrium holds depends on how migration flows adjust to changes in nominal wages, prices, and amenities. Chauvin et al. (2016) find that the conditions for a spatial equilibrium hold better in the U.S. than in Brazil, China and India, perhaps due to greater frictions in developing countries. While migration rates are high, they would be higher were it not for explicit migration restrictions (i.e. the Hukou system in China) or heterogeneity of tastes (as in India where there is little migration across state lines due to cultural differences). In developing countries today migration is driven by differences in income and not amenities (Chauvin et al., 2016; Meijers et al., 2016). Was this also true of medieval cities?

For unskilled workers wages were close to the subsistence level until the Black Death of the mid-14th century, after which wages rose (Allen, 2001). If wages are close to the subsistence level and if utility increases concavely with income, then even minor wage difference across cities could have important utility benefits for migrants.

There were major wage differences across Europe in the late Middle Ages. Indeed, for unskilled workers, if we compare cities in the same decade, the 90th percentile in real wages (i.e., net of prices) in the Allen data (see footnote 12) is about 3.4 times larger than the 10th percentile, thus suggesting that a worker might become 340% wealthier by migrating from one of the poorest cities to one of the wealthiest cities. However, this might have required migrating

[16]This framework is summarized by Glaeser and Gottlieb (2009).

across a large part of the continent which was hardly feasible for large numbers of individuals in a period of high information and transportation costs and legal and cultural barriers.

Nonetheless, there is historical evidence that both unskilled and skilled workers moved across cities to obtain higher wages. Nicholas (2014, p. 181) notes, "Preindustrial populations have extremely high death rates—as much as 6 per cent even in normal years. Cities thus can grow only if immigration compensates for or exceeds natural losses". By his estimate, one-quarter to half of the population of most growing medieval cities constituted migrants from the immediate environs—often emancipated serfs.

Data on housing costs is not available for most of preindustrial Europe. As Allen (2001, 422) notes, the reason for this is that housing costs were a small (5-10%) part of the budgets of pre-modern workers. Medieval cities were walled for defensive purposes. Despite their being evidence of active real estate markets within the city boundaries, especially by the thirteenth century (see, e.g., Nicholas (2014, p. 189-191)), housing supply was likely highly inelastic, making it difficult for the spatial equilibrium condition to be satisfied. However, housing markets did develop "beyond the walls". For example, Pirenne (1925a) writes: "[From the 10th century, the] newcomers grew more and more numerous and cumbersome as traffic grew heavier, however, and the towns and burgs soon ceased to afford enough room to accommodate their swelling ranks. The merchants were obliged to overflow the boundaries of the old burg and to establish alongside it a new one or, to use an expression that denotes exactly what is involved, a faubourg, deriving from the Latin foris-burgus, meaning the 'outer burg'."[17]

Finally, perhaps the most important amenity offered by medieval cities was defense; cities often had walls and militias and were, thus, "safe harbors" (Dincecco and Onorato, 2017; Ioannides and Zhang, 2017). Between 800-1000 Europe was beset by attacks from Vikings, Magyars, and Arab raids (Ko et al., 2018). This provided an incentive for rural populations to move to cities–for example in England, many towns and cities descend from *burhs* or fortresses built to defend against Viking raids (Nicholas, 1997, 60). After 1000, this external threat receded but internecine low-level violence was endemic. Rural populations would crowd into the citadel or behind the city walls, if they existed, for defense. The rise of larger states and more sustained warfare—often directed against the countryside —after 1300 provided a more sustained incentive for rural-urban migration, particularly in regions where conflict occurred on a frequent basis, such as the Low Countries and Northern Italy.

[17]Walls and many civic buildings (e.g. churches, cathedrals, town halls, etc ...) were also durable investments. As explained by Glaeser and Gottlieb (2009) citing Glaeser and Gyourko (2005), "durable housing may cause urban responses to productivity shocks to be spread over decades". Indeed, if housing is durable, a negative wage shocks in a location reduces housing prices, thus mitigating individuals' migration responses to the wage shock.

6. The Urban Demographic Penalty, Low Mobility, and City Growth?

Pre-industrial cities were not healthy places. Low incomes constrained nutrition, city residents had limited access to clean water, sanitation systems were almost non-existent, and congestion aggravated the spread of disease (Coale and Watkins, 1986; Brown, 1992; Woods, 2007).[18] As a result, pre-industrial cities had low, or even negative, rates of natural increase, and grew only through migration (Jebwab et al., 2015; Jedwab and Vollrath, 2019; Gindelsky and Jebwab, 2020).

However, Europe consisted of many states that were much smaller than today (Abramson, 2017). In addition, there were linguistic and cultural constraints. Migrants, even within the same country, were regarded as "foreigners". Transportation costs were also high and limited information technologies prevented workers from learning about opportunities in other locations. Finally, labor markets were not well developed for much of the period (North and Thomas, 1971). In rural areas Ogilvie and Carus (2014) argue that serfdom severely restricted the ability of peasants to move. In urban areas, authorities and guilds limited the influx of new workers, except when there were important needs, and these workers often could not become citizens of the city (Ogilvie, 2019).

As a result of low or negative rates of natural increase and low rates of migration, city growth was severely constrained. Indeed, based on the Bairoch data, the average annual percentage growth rate of cities above 2,000 between 800 and 1500 was 0.6%—mostly driven by migration. During the Industrial Revolution (1750-1850), by contrast, the average growth rate was 3.2%. The analyses of Jedwab et al. (2017b) and Gindelsky and Jebwab (2020) suggest average urban crude rates of natural increase of 0.5% per year for the latter period, thus implying that migration rates were 3.2 - 0.5 = 2.7%—four times the migration rate during the medieval period.

7. The Effects of Pandemics and Epidemics on Medieval Cities

Epidemic disease had a major impact on cities during the medieval period. These shocks reduced city populations without directly affecting physical capital (unlike wars or fires, for example). Human capital may have been directly impacted, however, if the pandemic or epidemic disproportionately killed some parts of the population (e.g. poorer or older residents), and indirectly impacted if skill demand and supply factors were differentially affected.

Using paleo-archeological data, economic historians continue to find evidence that waves of

[18] Coale and Watkins (1986) explain that "pre-industrial populations had high mortality because uncertain food supplies and unavoidable disease made low mortality unachievable; fertility was only moderately high because of low populations married and birth intervals that are extended by various [...] factors." Brown (1992) writes: "pre-industrial populations were afflicted by 'demographic crises', sharp rises in mortality and falls in conceptions and marriages. Such crises were [...] usually the results of epidemics."

disease and climate change have played a key role in determining the growth paths of, not just cities, but entire civilizations. For example, Manning et al. (2017) find that a string of major volcanic eruptions hastened the collapse of the Ptolemaic Dynasty in Egypt. The Plague of Justinian (541-542) killed 25-50% of the Mediterranean population and hastened the collapse of the Roman Empire (Harper, 2017; Scheidel, 2018).[19] Subsequent plague outbreaks continued to strike until 750, though the disease became less virulent and more localized.

Campbell (2016) argues that a series of pandemics, zoonotics, and climate change played a key role in driving what scholars refer to as the "Great Transition" in Europe during the late thirteenth to the mid-fifteenth century. This saw the shift out of a labor-abundant, low wage, equilibrium that held after an extended period of population growth that accompanied the Commercial Revolution. Along with this shift, came a shift in the economic and urban center of gravity of Western Eurasia from the south-east towards the north-west. Among the drivers of this transition was the end of the Medieval Warm Period, a catastrophic series of harvests accompanied by panzootics that struck European sheep and cattle, killing between 15% and 20% of them, between 1315 and 1320, which all combined to trigger the Great Famine (1315-1322) that killed between 10% and 25% of the population.

Without question, however, the key event in this series of disasters was the Black Death that struck Europe between 1347-1352 and killed approximately 40% of the population. Voigtländer and Voth (2013) argue that the Black Death raised wages substantially, mostly because of high land-to-labor ratios. Due to non-homothetic preferences, higher incomes translated into a higher demand for urban products and cities grew as a result. However, since cities also had higher death rates, increased urbanization rates after the Black Death raised aggregate mortality rates, thus contributing to a self-reinforcing increase in per capita incomes. Indeed, in the Malthusian model, increases in per capita incomes are eventually cancelled out by increases in net fertility (Galor, 2011), which did not happen in this context. Thus, the Great Divergence between Europe and China can be partly explained by the urbanizing effects of the Black Death.

There has also been a series of recent papers investigating the economic and social impacts of the Black Death (1347-1352) at the city level. Jedwab, Johnson and Koyama (2019b) use data on Black Death mortality rates in 165 cities to test the short and long-run impacts on city growth. They find significant negative spillover and general equilibrium effects of the Black Death on city populations in the short run, but no effects in the long run. By 1500, on average, cities had recovered to their pre-Plague population levels. However, they find a significant amount of heterogeneity in recovery across cities—for example cities like Narbonne or Winchester shrank

[19] These high numbers have been questioned (Mordechai et al., 2019).

to insignificance after the plague whereas Hamburg and Liège took off. Jedwab, Johnson and Koyama (2019b) show that variation in recovery can be almost completely explained by urban and rural fixed factors, including access to trade routes and potential soil suitability. They also find evidence for an urban reset—with successful cities accounting for the majority of population growth on rivers post-plague, for example. The plague continued to recur, in a less virulent form, for the rest of the Middle Ages, constraining urban growth.[20]

8. State and Local Institutions and Medieval Cities

We now turn our attention to the relationship between political institutions and medieval cities. Max Weber (1922, 1968) argued that the form of self-government that arose in medieval European cities played a crucial role in the rise of Europe and liberal democracies. Many scholars have followed up on this insight (including Pirenne, 1925b). Bairoch (p.170 1988) went so far as to label these cities as a "school of democracy." To what extent is this generalization valid? And what was the relationship between states, local institutions, and urban development?

Beginning in the 10th and 11th centuries cities in northern Italy overthrew the authority of the Holy Roman emperor and established self-governing institutions, known as communes (Wahl, 2016b). These institutions spread to Germany and the Low Countries. Over time, these cities developed representative political institutions characterized by merchants participating in government, open competition for office, and rule by some of form council. For this reason, Acemoglu and Robinson (2019) see the rise of independent city states as crucial to the emergence of a "shackled leviathan".

Studying Venice, Puga and Trefler (2014) document how the growth of trade gave rise to a new merchant class. These merchants ended the hereditary rule of the Doge (equivalent to monarchs) in 1032, replacing this system with a set of more inclusive institutions in which doges were elected by merchants. They also established a Great Council in 1172, constraining the power of the doges. The merchant class, due to their wealth and influence, controlled most council seats. Independent cities like Venice, Genoa and Florence expanded rapidly during the Commercial Revolution: Florence reached 95,000 by 1300; Venice reached 110,000.

In the longer-run, however, the economic vibrancy of self-governing cities faded away. Stasavage (2014) finds that in their first two centuries of independence self-governing cities grew faster than non-self-governing cities. Subsequently, this growth advantage reversed itself. This is consistent with accounts that suggest that while merchants established institutions that

[20] Biraben (1975) provides city-level data on 7,000 of these re-occurrences on the extensive margin. There are no consistent sources of mortality rates for such recurrences, though they were much less virulent than the Black Death.

supported markets and protect rights, they also established barriers to entry. Over time, these dynamic costs slowed the growth of independent cities. In addition to internal rent-seeking, the costs of external conflict, particularly after 1350, can help to explain why sustained economic growth did not begin in these self-governing medieval cities, but in larger states.[21]

Even in large-states, city-level institutions played an important role. Looking within England, Angelucci et al. (2017) find that cities granted local fiscal autonomy in the Middle Ages provided the basis for the more inclusive political institutions later. More generally, after 1200 parliaments emerged that represented urban interests (Zanden et al., 2012). De Long and Shleifer (1993) finds that cities in absolutist monarchies grew slower between 1000 and 1800, mostly due to higher rates of taxation. Cox (2017) argues that there were spillover benefits to political liberty and urban autonomy. He finds that between 600-1100 CE in both Europe and the Middle East there was no correlation between the growth of the largest city in a region and that of other cities. But after 1100 this correlation becomes positive in Europe, but not in the Middle East. Cox (2017) argues this represents changing institutions in Western Europe, specifically representative institutions that promoted trade between cities. When sustained economic growth began in Northwestern Europe after 1700, it was no accident that it did so in the most urbanized regions of the continent.

9. Questions For Future Research

In the past 25 years there have been many studies of medieval economic development using urban data. Many of these take an institutional perspective and use city population growth as a proxy for growth more generally. Nonetheless, there is plenty of scope for future research. Creating an equivalent dataset to Bairoch et al. (1988) for China and the rest of East Asia has proven a difficult challenge but one that would greatly benefit comparative studies of urban development. There is also scope for refining and improving the Bairoch dataset both by improving estimates for individual cities and extending it backwards in time.

From the perspective of an urban economist, the field would benefit from more quantitative descriptive analyses and causal evidence on the relative importance of (i) food surpluses; (ii) economies of scale and agglomeration effects; (iii) human capital; (iv) housing markets and labor mobility; and (v) demographics in urban growth. Gaining further traction on these questions will require both the collection of novel datasets (here archeology offers numerous opportunities) and the exploitation of novel natural experiments and historical shocks.

[21] See Johnson and Koyama (2017b) for a survey of the role played by states in generating growth during the pre-modern period.

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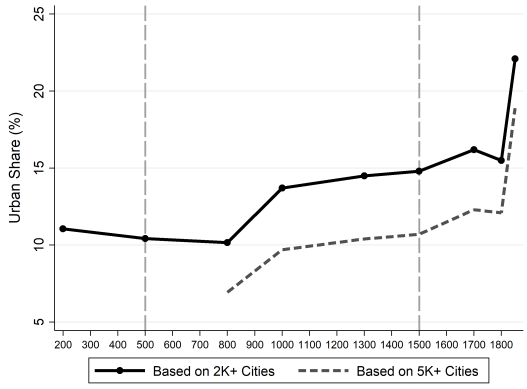
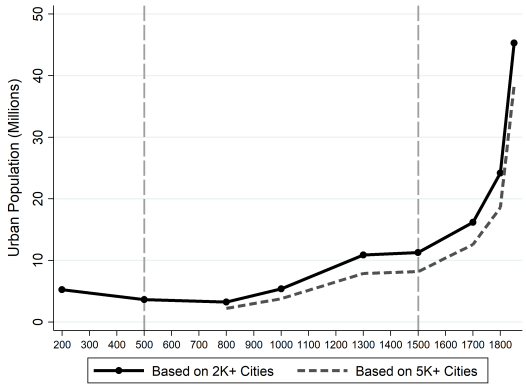
Figure 1: Urbanization Patterns for Europe (Excluding Russia), 200-1850

(a) Urban Share



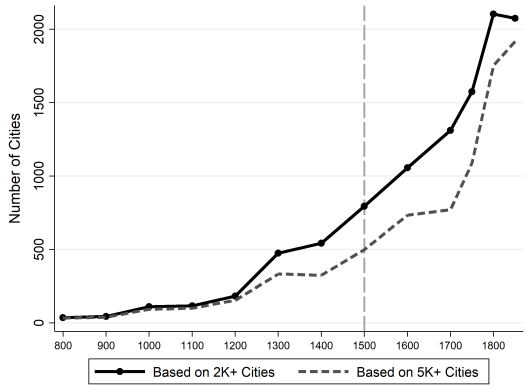
(b) Total Urban Population



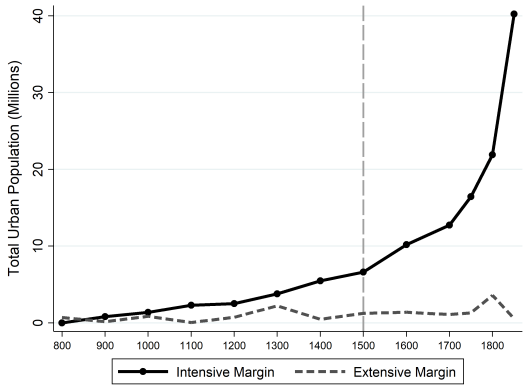
Notes: Subfigure 1a shows for the whole of Europe (excluding Russia) in 200-1850 the estimated urban shares based on cities above 2,000 and 5,000 inhabitants. Subfigure 1b shows for the whole of Europe (excluding Russia) in 200-1850 the estimated total urban populations based on cities above 2,000 and 5,000 inhabitants. The dashed vertical lines show the years 500 and 1500, the years that we use to define the medieval period. See text for details on sources.

Figure 2: City Population Patterns for Europe (Including Russia), 800-1850

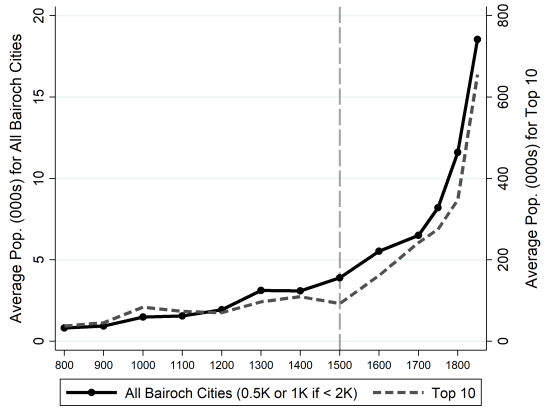
(a) Number of Cities



(b) Intensive vs. Extensive Margin

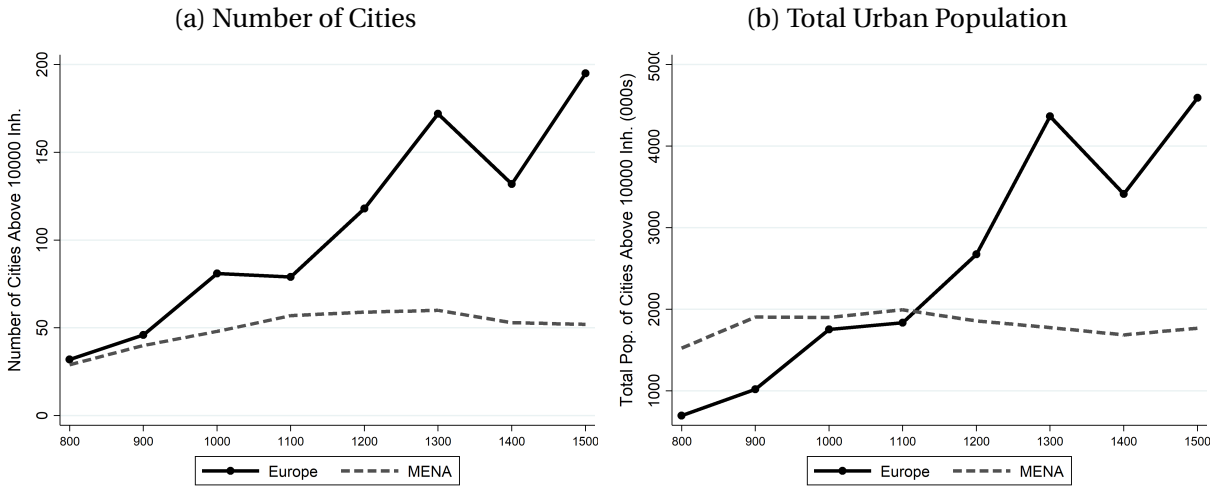


(c) Average City Size



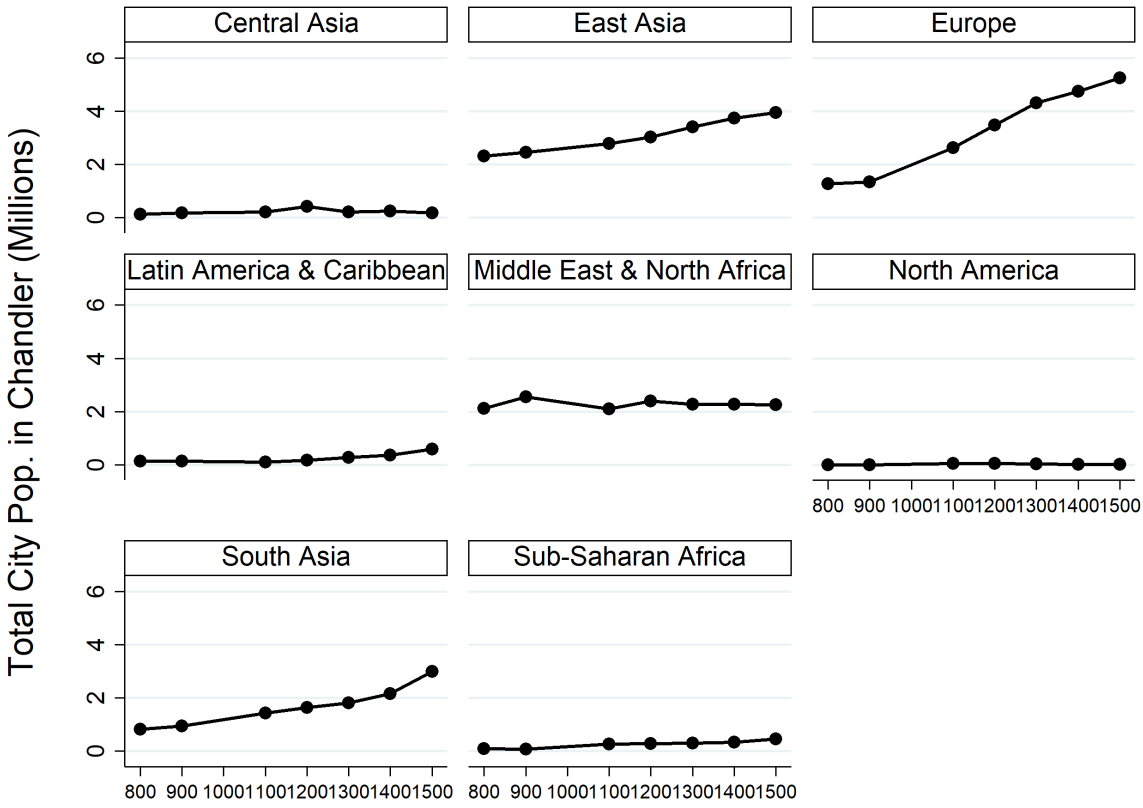
Notes: Subfigure 2a shows for Europe the respective numbers on cities above 2,000 and 5,000 inh. Subfigure 2b shows for Europe for each year t the total urban population respectively coming from cities that existed in t-1 or new cities. Subfigure 2c shows for Europe the average size of all Bairoch cities (using 1K when reported as such or 0.5K if the city has less than 1K) and the 10 largest cities in each year t. See text for details on sources.

Figure 3: City Population Patterns for Europe vs. the Middle-East and North Africa, 800-1850



Notes: Subfigure 3a shows the respective numbers of cities above 10,000 inhabitants in Europe (incl. Russia) and in the Middle-East and North Africa ("MENA") between 800 and 1500. Subfigure 3b shows the respective total urban population of cities above 10,000 inhabitants in Europe (incl. Russia) and in the Middle-East and North Africa ("MENA") between 800 and 1500. The MENA does not include countries beyond Iraq. See text for details on sources.

Figure 4: Total City Population of Selected Regions in Chandler (1974, 1987), 800-1500



Notes: This figure shows for selected regions of the world the total population of cities appearing circa each year t in the database of Chandler (1974, 1987). More precisely, Chandler (1974, 1987) reports population estimates for 435 cities for selected years during the period 800-1500. We interpolate population between years. We then use for each year t the population in year t if it is available, and if it is not we use the mean population of each city in the period (t-50; t+50) in order to maximize the number of cities with a population estimate in each year t.